REMARKS

Applicants thank the Examiner for the thorough consideration given the present application. Claims 1-3, 6-22, and 24-27 are pending, of which claims 1, 16, 17, and 20 are independent.

Attached are replacements sheets for FIGS. 1 and 2 in which these drawings are identified as "PRIOR ART."

The title is amended to read, "METHOD OF INTERPOLATION, COMPUTER PROGRAMMED TO PERFORM INTERPOLATION, AND A PROGRAM STORAGE MEDIUM FOR CONTROLLING A COMPUTER TO CAUSE INTERPOLATION." The title suggested in the Office Action, "Method of color interpolation," is not descriptive of the claimed subject matter because the broadest claims of the present application are not limited to color interpolation. However, the amended title is consistent with the claimed subject matter, which is directed to a method of interpolation, a computer programmed so that interpolation is provided thereby, and a program storage medium readable by a computer.

The specification is amended as requested in the Office Action to properly identify the paragraph beginning on page 3, line 1, of the application as filed. In addition, the Abstract is amended to comply with USPTO requirements.

Claim 23 is cancelled, thereby obviating the double-patenting rejection. Claims 1, 3, 6-10, 13, 16, 17, 19, 20, and 22 are amended

for clarity. Claims 24-27 are added to provide Applicant with the protection to which he is deemed entitled.

Applicant traverses the rejection of claims 1-3, 6-11, and 14-19 under 35 U.S.C. §103(a) as being unpatentable over Sakamoto et al. (U.S. 4,275,413) in view of Miyake (U.S. 6,415,065).

Contrary to the assertion in the paragraph bridging pages 4 and 5 of the Office Action, Sakamoto does not disclose establishing a value for a given lattice point by using the values of only m of (n+1) known lattice points defining an n-simplex touching or enclosing the given lattice point, wherein m is a positive integer equal to the number of n-simplexes of non-zero volume whose vertices consist of the given lattice point and n of the (n+1) known lattice point values, and by returning a weighted average of the m of the known value lattice points.

The Office Action states Sakamoto discloses the foregoing feature at column 9, line 50, through column 10, line 24. In fact, this passage describes a method in which a unit cube is dissected into six tetrahedra by three planes having in common a line which is the long diagonal of the cube. Each of the planes is inclined to the other two by 60 degrees and includes two edges and four vertices of the unit cube. The conditions for the point P to lie within the tetrahedron of FIG. 10 are set forth as $x_f \geqq y_f \geqq z_f$. The interpolated value of point

P is based on six different discrimination tables as set forth in Table T2.

The apparatus employed by Sakamoto is illustrated in FIG. 13 and includes a detector for each of the primary colors of red, green, and blue. The detected color values are converted into digital signals having 8 bits. The four higher order bits are supplied to adders 4, while the four lower order bits are supplied to comparator 5, as well as coefficient selector 7. Any signal meeting the magnitude requirements of Table 2 is supplied to selectors 6 and coefficient selector 7. In selector 6, the input signal is accessed four times by a read timing clock 8. A determination is made as to which of the four higher order bit signals of the blue, green, and red output signals of converters 3 is to have its magnitude incremented by 1 is obtained by supplying the output of comparator 5 to selector 6. The resulting outputs of adders 4 are supplied to memory 9, which stores color-corrected signals according to each of the combinations of higher order 4-bit signals. Memory 9 drives registers 10-13, which store color-corrected signals that are accessed by clock signals from clock 8. Each of registers 10-13 is respectively connected to multipliers 14-17, which multiply the color-corrected signals stored in registers 10-14 by 4-bit signals derived from coefficient selector 7.

A description of the operation of comparator 5, selector 6, adders 4, memory 9, and registers 10-13 is found in Sakamoto at column

6, line 57, through column 13. Selector 6 responds to the output signals of comparator 5 by deciding which one of the 4-bit higher order signals, as derived from analog-to-digital converter 3_B, 3_G, or 3_R, is to have to a 1 added to it. During the first output time of converters 3_B, 3_G, or 3_R, the color-corrected signals themselves corresponding to the addresses of B, G, and R are accessed and stored in register 10, irrespective of the magnitude of the blue, green, and red signals. During the next output time, 1 is added to any one of the four higher order addresses corresponding to the signal having the largest value of the four inputs to comparator 5, i.e., to the four lower order bits supplied to comparator 5. In other words, a 1 is added only to the address of R if r has the largest value.

During the third output time, 1 is added to two of the higher order addresses corresponding to the largest and next-to-largest values of r, g, and b so that, e.g., a color-corrected signal having an address of R+1, G+1, B is addressed. During the fourth output time, 1 is added to all of the higher order addresses, and a color-corrected signal, whose address is R+1, G+1, D+1, is accessed to be stored in register 13.

The output of adder 18 is supplied to limiter 19, which drives memory 20, the contents of which are read out by controlling the access timing for it. The output of memory 20 is supplied to DAC 21 to

generate a final analog output signal; column 11, line 65, through column 12, line 14.

Based on the foregoing, Applicant cannot understand the basis for the statement in the Office Action on pages 4 and 5 that Sakamoto establishes a value for a given lattice point. Further, Applicant is unable to find any basis in Sakamoto for the statement on page 5 of the Office Action that a weighted average of all four known value lattice point values is used if the given lattice point is enclosed by the tetrahedron but is not touched by a face of the tetrahedron, a weighted average of three of the four known value lattice point values is used if the given lattice point is on a face of the tetrahedron and bounded by three of the four known value lattice points but is not touched by an edge of the tetrahedron, a weighted average of two of the four known lattice value point values is used if the given lattice point is on an edge of the tetrahedron bounded by two of the four known value lattice points but is not at a vertex of the tetrahedron, and wherein a value of one of the known value lattice points is used if the given lattice point is also the known value lattice point.

In this regard, Applicant notes that column 10, lines 1-4, of Sakamoto indicates an advantage of the method discussed in connection with FIGS. 9 and 10 is that no averaging of values at the vertices of the unit cube is necessary to determine values at the centers of the faces of the inner cube and at its center.

Applicant can find no basis in Sakamoto for the position in paragraph (a) on page 6 of the Office Action. Applicant does not concede that column 10, lines 6-24, of Sakamoto inherently teaches the equation set forth in Applicant's claim 6 and respectfully requests the Examiner to provide some rationale for this assertion.

The Office Action admits Sakamoto does not explicitly disclose determining the values of only m of (n+1) known value lattice points defining an n simplex touching or enclosing the given lattice point, as required by claim 1. The Office Action relies on Miyake to disclose determining the values of only m of (n+1) known value lattice points defining an n simplex touching or enclosing the given lattice point for tetrahedron interpolation. The Examiner says this determining step is found at column 12, line 43, through column 13, line 31, of Miyake.

The portion of Miyake relied on in the Office Action relates to FIG. 12 of the reference. FIG. 12 of Miyake illustrates using four or fewer lattice points for interpolation if the input information has a relative position within a tetrahedron formed by lattice points a, b, c, and e in FIG. 9. The interpolation coefficients in such combinations are experimentally calculated in advance and stored in look-up Table 105 of FIG. 12. In the embodiment of FIG. 12, the upper bits derived by quantization units 801 are supplied for each color to lattice point determination unit 303. The lower bits of the outputs of quantization unit 801 are supplied to interpolation coefficient

generation unit 302, which generates interpolation coefficients corresponding to two vertices that are on diagonals of the faces of the cube of FIG. 9. In this regard, column 13, line 13, states that if the input image data is positioned on the diagonal a-d (the bottom plane of the cube of FIG. 9), a-f (the front face of the cube of FIG. 9), a-g (the left face of the cube of FIG. 9), or a-h (the diagonal between the lower left and upper right vertices of FIG. 9), the interpolation coefficient unit 302 generates the interpolation coefficients corresponding to the respective two vertices, i.e., (a-d), (a-f), (a-g), or (a-h). The interpolation can be along the diagonal and does not have to be on the exterior face.

The interpolation coefficients generated by unit 302 are supplied to lattice point determination unit 303 that calculates the approximate color values corresponding to the image data. The coefficients are supplied to look-up Table 105, which stores correction values matching the color reproduction characteristics specific to an output device for each quantization point. The look-up table requires an address capacity of about $(2^{(m+1)})^3$, wherein m is an experimentally determined quantity based on the capacity of Table 105, image quality, and other hardware aspects such as processing speed. Look-up Table 105 supplies signals to approximate color value calculation unit 304, also responsive to interpolation coefficient generation unit 302.

Approximate value color calculation unit 304 performs interpolation; see column 13, line 13.

Based on the foregoing, Applicant is unable to completely understand the statement in the Office Action that the embodiment of FIG. 12 OF Miyake shows determining and selecting 4, 3, and 2 vertices when a to-be-interpolated point is inside a tetrahedron, on a face of the tetrahedron, and on a line of the tetrahedron, respectively. Explanation is requested and, under U.S. law, is required.

Applicant is unable to determine how the structure illustrated in FIG. 12 of Miyake can be employed in the system shown in FIG. 13 of Sakamoto. If the rejection is maintained, the Examiner is requested to indicate how the Sakamoto structure of FIG. 13 is to be modified in view of FIG. 12 of Miyake. Where does any of interpolation coefficient generation unit 302, lattice point determination unit 303, look-up Table 105, and approximate value calculation unit 304 of Miyake fit in the FIG. 13 configuration of Sakamoto?

The FIG. 12 embodiment of Miyake does not include details similar to those shown in the FIGS. 1 and 6 embodiments of Miyake. For example, FIG. 4 is a detailed flow diagram of the control sequence for approximate value calculator in the embodiment of FIG. 1. FIG. 7 is a flow diagram of the control sequence for the approximate value calculator of FIG. 6. FIG. 8 is a flow diagram of the setting sequence for the interpolation coefficient in the embodiment of FIG. 6. FIG. 10

is a table with an example of generating the interpolation coefficient of the FIG. 8 embodiment. The discussion of the third embodiment beginning at column 12, line 17, indicates the interpolation technique of the embodiment of FIG. 6 is not employed in the embodiment of FIG. 12. However, Miyake provides no information as to what is in the interpolation coefficient generation unit 302, nor does the reference provide any indication of the operations or structure of approximate value calculation unit 304. Hence, the disclosure of Miyake appears to be insufficient with regard to the embodiment of FIG. 12, which Applicant notes is quite different from the embodiments of FIGS. 1, 6, and 13 because the embodiment of FIG. 12 does not include a dither signal generation unit.

Applicant cannot agree that Sakamoto discloses the claim 15 step of providing the weighted average to include using the positions as inputs to a jump table. The Examiner states that Table 2 is a jump table because it uses the results of discrimination conditions listed in column 1 for factors of use for interpolation of a given lattice in one possible tetrahedron and because the result given in column 1 provides a pointer for an assigned equation associated with the factors enables Table 2 to be considered a jump table. However, a jump table is a computational structure not found in Sakamoto. In any event, claim 27 is added to define a jump table more particularly. A jump table is discussed in the present disclosure at page 11, line 17,

through page 13, line 46. Clearly, Sakamoto does not disclose the subject matter of claim 27.

Applicant traverses the rejection of claims 20-22 under 35 U.S.C. §103(a) as being unpatentable over Sakamoto and Miyake in view of Schoolcraft et al. (U.S. 6,466,333). Claim 20 is similar to method claim 1, except claim 20 is directed to a program storage medium, and Schoolcraft fails to cure the above-noted shortcomings of Sakamoto and Miyake with respect to claim 1.

Applicant traverses the rejection of claims 12 and 13 under 35 U.S.C. §103(a) as being unpatentable over Sakamoto and Miyake in view of Yip et al. (U.S. 6,289,138). Yip does not cure the above-noted deficiencies of Sakamoto and Miyake with respect to claim 1, upon which claims 12 and 13 ultimately depend.

In view of the foregoing amendments and remarks, it is respectfully submitted that independent claims 1, 16, 17, and 20 are allowable. The remaining claims are allowable due to dependence, directly or by extension, on these allowable independent claims, as well as for the additional limitations provided by the dependent claims.

New claims 24-26 are also allowable over the cited references. These claims require the (n+1) known lattice points to enclose the given lattice point such that the given lattice point is not coincident with any of the known value lattice points, and the known value lattice

points do not define an n-simplex touching the given lattice point, and the given lattice point is not a diagonal between any known value lattice point of the n-simplex. The foregoing discussion of the embodiment of FIG. 12 of Miyake indicates any interpolation that might be performed is on the planes of the faces of the cube or on a diagonal between opposite vertices of a cube.

Favorable reconsideration and allowance of the application are, therefore, deemed in order.

To the extent necessary during prosecution, Applicant hereby requests any required extension of time not otherwise requested and hereby authorizes the Commissioner to charge any prescribed fees not otherwise provided for, including application processing, extension of time, and extra claims fees, to Deposit Account No. 08-2025.

Respectfully submitted,
Peter HEMINGWAY

By: Allan M. Lowe
Allan M. Lowe, #19,641

HP IPA
P. O. Box 272400
Fort Collins, CO 80527-2400
703-684-1111 telephone
970-898-0640 telecopier
AML: rk